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The current practice in most schools of selecting instructional films on the basis of their availability and compatability with particular curricula does not allow the evaluation of the film's effectiveness in achieving its ultimate goal, namely, significant learning in the pupil. This study explores a method of evaluating a particular film and of producing a film with greater ability to teach. The verbal message of the film is broken into paragraphs concerned with common topics. Questions testing the information contained in each paragraph are administered to two groups, one which has heard only the sound track of the film and one which has seen the entire film. The improvement in the ability of the students to answer questions after seeing the complete audiovisual presentation, which is significant, provides a test for the effectiveness of each part of the instructional film. However, the relationship between quiz item, answer alternative, and the instructional film, reveals itself to be unexpectedly complex. (BB)

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Introduction

The instructional film is ubiquitous in American education. Sixteen millimeter and, more recently, eight millimeter projection apparatus can be found in almost any school, and a continuous flow of new instructional films is offered to educators by large and small firms. The decision to produce instructional films on specific subjects is usually taken after examination of the school curricula and currently available films in particular areas, and the standard method for film sales is that of preview prior to purchase.

The selection of which films to purchase is usually made after preview by committees consisting of audio-visual supervisors, curriculum supervisors within the school system and perhaps classroom teachers, who view the films and evaluate them. To draw a crude analogy, it is as if a department store clothing buyer and some salesmen examine clothing available from manufacturers in order to decide which models should be stocked. The acid test for the clothing buyer is, of course, whether his ideas of acceptability are congruent with the needs and desires of the retail customer.

In education, the issue of how the instructional materials fit the needs of the pupil, who is after all the ultimate consumer of the materials, is decided by the audio-visual supervisors and curriculum specialists on the basis of 1) what is available in the marketplace, and 2) how the film fits into the existing curriculum.

From time to time attempts are made to evaluate the effectiveness of instructional films, but in the absence of systematic methods and specifiable criteria, this is too often speculative and impressionistic.

The research reported in the following pages proceeded from the assumption that a reasonably quick and economical way of systematically evaluating the effectiveness of instructional films would provide for a more enlightened film acquisition policy than was previously possible, more efficient utilization of limited budgets, and most important, increased teaching effectiveness. In what has become a multimillion dollar industry which pervades all of education, surely it is not extreme to suggest that the choice of instructional film teaching materials should be made on the basis of some predictability of their meeting specified educational criteria, and the needs of the pupils which are presumed to be instructed by "instructional films."

Our final field study was set up to take what was in our judgment a good example of an educational film currently being shown in the classroom. This report will concentrate on the work completed to date which attempted to develop some reasonably economical and quick way to assess the effectiveness of existing instructional films. A later report will concern itself with the construction of new films.

The film titled The Olive Industry (Barr Productions) was chosen for detailed analysis and evaluation. The Olive Industry is

a color film of approximately nine and one-half (9 1/2) minutes length which attempts to familiarize the viewer with a variety of features of the subject matter referred to in the title. A more detailed description of the objectives of this film, inferred from many viewings and much discussion of what the film actually contains, might run as follows:

1. This film was apparently designed in part as a public relations tool for the Olive Growers Association and the State of California. The general message it carries presents only favorable reflections of the industry and praising comments about California; there are no disgruntled workers, discussion of labor-management interaction, or rotten olives. References to maximizing profits are toned down into remarks about the relative "value" of processing olives in different ways.

2. Esthetically, the visual portion of the film employs a photographic quality not unlike a travelogue or "National Geographic" production. Pretty pictures abound; color is exploited and the absence of unpleasant visuals gives the film a "too-good-to-be-true" quality.

3. Informationally, the film is evaluated by us as a bit overambitious. It presents such an extensive range

of information in nine and one-half minutes, from the history of the importation of olives to California through the nitty-gritty of processing, pitting and packing, labeling and boxing, etc., that a certain amount of confusion and misunderstanding is inevitable. This functional aspect of the film was our major interest, and was the focus of the analysis which follows.

Analysis of the film

Several careful viewings of the film revealed little evidence to disagree with the general statement that the informational content of the film is largely conveyed via the auditory or verbal stimulus dimension. The visual portion of the vilm primarily illustrates the narrative verbal message and rarely attempts to add information. In analyzing the informational content of the film then, the initial and predominant orientation was on sound and a transcript of the narration.

The narrative voice is a clear, evenly paced, bass male voice which is mostly devoid of more than moderate variations in inflection and intonation; while the narrator never evinces enthusiasm or excitement, his delivery is never dull or monotonous. Sentence construction is simple and easy to follow. Sentences are periodically separated by visual sequences or fades so that sentence-to-sentence pace as well as intrasentence word-by-word pace is not hurried.

The technical sound fidelity, or general sound quality of the film is quite good when reproduced through optical pickup and the electronic amplification of an ordinary 16 mm movie projector.

Our first approach to an analysis of the verbal message was to combine temporally adjacent sentences into sets, or paragraphs, on the basis of a common topic. For example, the first four sentences of the film discuss the history of the importation of a few olive trees into California by Catholic padres and the transition to the extensive orchards which exist today. For purposes of later coordination to the visual aspects of the film, and to facilitate the otherwise difficult business of locating specific segments of a film for viewing/listening, each paragraph was assigned a pair of four-digit identification numbers which corresponded to its beginning and end in terms of footage and frames on the filmstock. Appendix A presents the preliminary informational analysis.

Next, a similar analysis was attempted on the visual sequences in the film with the accompanying sound turned off. It quickly became apparent that no criteria could be formulated which would break the visual into even reasonably unambiguous "sentences" and/or "paragraphs." For example, a rather long sequence showing a man dumping olives into a hopper belongs, conceptually, neither to what preceded it -- a sequence showing various steps in the production of olive oil -- nor to what follows -- a sequence showing various aspects of the care of olive trees. Alone, it contains nothing

which one might want students to learn, though it is a charming slice out of the workaday life of an olive plant worker. The analysis of the silent, visual sequences was thus abandoned in favor of a refocus on the structure imposed on the film by the narration.

Additional viewing of the film brought our attention to the fact that the visuals in the film were temporally more or less synched, in terms of context, to the narration. In the majority of cases, a sentence of the narration was accompanied by visual information which related to the narration more or less directly. Sometimes, the onset of the accompanying visual temporally preceded the onset of a portion of narration; sometimes the narration commenced and the visual accompaniment followed after a short delay. Taking these small temporal variations into account, a complete script of the film (see Appendix B) was produced including a verbatim transcript of the narration, broken down into paragraphs and sentences, with a relatively brief description of the accompanying visual.

Testing the film

The first step in testing the teaching effectiveness of the film was, of course, the construction of test items. A multiple-choice format was chosen for all but two questions which required short sentence-completion type answers. The multiple-choice questions contained from two to four answer alternatives. Each quiz

question was clearly identified as pertinent to a particular paragraph (see column II of Appendix B) of the film and an attempt was made to write at least one test item for each paragraph of the film. Thus the quiz itself was constructed to test only material obviously contained in the film and to test over the entire range of information offered. A copy of the quiz is attached as Appendix C.

Before actually showing the film and administering the test, we next proceeded to predict the extent to which the film would improve test performance over a lecture-style lesson containing the same factual information. A prediction was made for each item in the quiz in the following way:

1. With the film threaded for viewing, an item was read to insure immediate familiarity with what it asked and the precise wording of the answer alternatives.
2. The relevant portion of the film (the portion from which the item had been generated) was viewed.
3. That film-segment/test-item was given a prediction score or rating, on the following scale:

Visual Contradicts Verbal: Active Confusion	Visual Unrelated To Verbal	Visual Minimally Illustrates Verbal	Visual Adequately Illustrates Verbal	Visual Completely Illustrates Verbal
-1	0	+1	+2	+3

This scale has two features worth commenting on; first, it is asymetrical. This is due in large part to the fact that the film was constructed with illustration in mind. There were almost no cases of -1 ratings, we assume because the film maker eliminated most of them. Second, the 0 to +3 portion of the scale carries verbal labels that reflect our focus on the narration as the central carrier of information and the visual as illustration, support, example, or general supplement.

An example of the process of predicting the effectiveness of the film is as follows:

Test Item:

8. What kind of equipment is used to crush olives today?

   (a) stone wheels

   (b) metal wheels

   (c) wooden wheels

   (d) none of the above

Related part of film: IIIa (see Appendix B)

Rating: +3

Basis of rating: Visual is very complete illustration of information content of narration; visual shows stone wheel rolling in trough full of crushed olives.

Testing was run in two sessions with fourth- and fifth-grade children at Montague School in the Santa Clara Unified School District, Santa Clara, California.* In one session, 32 children heard only the sound track of the film, completed the quiz, and were shown the film. In the other session, 34 children saw the complete film and then completed the quiz. Thus the testing sessions allow us to look at the gain in quiz scores due to the overall audio-visual impact of the film as compared with an audio-only presentation.

Results

Of the 32 students in the sound only session, data from two were discarded because these two little girls quite openly and cheerfully collaborated in answering most quiz questions. Rather than inculcating them with the belief that cooperating is "cheating", we simply let them proceed. In all analyses, we discarded the two quiz items that called for sentence-completion answers, leaving 41 quiz items to work with.

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* We would like to express our gratitude to Raymond McKelvey, Utilization Coordinator for KGEH Channel 54 and Mrs. Pat Koepernik, Coordinator of Instructional Materials, for arranging for students to serve as subjects, and to Mrs. Charlotte Clementson, Principal of Montague School, for her cooperation in arranging equipment, space, and personally bringing the students to the experimental room.

In the "sound only condition", the proportion of the class answering each question correctly ranged from .10 to .77, with a mean of .45 and standard deviation of .20. The mean difference between fourth and fifth graders, .08, was not significantly greater than chance.

In the "film condition", the proportion of the class answering a question correctly ranged from 6% to 100% with a mean of 64% and a standard deviation of 24%, thus the "film condition" is associated with an increase of 19% in the proportion of students answering the average quiz question correctly. This increase is statistically significant ($t = 3.96$, $df = 80$, $p < .001$).

For each item of the quiz, we used the proportion of the "sound only" students answering correctly as a baseline and determined, by simple subtraction from 100%, how much improvement was possible. Then the difference between the proportion of "film condition" students and "sound only condition" students answering each item correctly was expressed as a fraction of the maximum possible improvement for that item. For example, only 20% of the students getting the "sound only" version answer item #8 correctly, leaving room for an 80% improvement; the proportion of "film condition" students answering this same question correctly was 63% for an actual improvement of 43%. This actual improvement score, when expressed as a fraction of 80% gives the film an effectiveness or improvement score of 54% for this quiz item. The distribution of

improvement scores ranged from -65%* to 100% with a mean of 20% and a standard deviation of 17%; given this standard deviation of individual item improvement scores about their mean, a distribution of sample means would be expected by estimation to have a standard deviation of 3.2% and the obtained mean of 20% is statistically different from a mean improvement score of zero (the no improvement null hypothesis; $t = 6.25$, $df = 40$, $p < .001$). This significant statistic is simply a reaffirmation of the fact that the film version is a more effective teacher than the sound track of the film played alone.

Table 1 shows the entire list of quiz items ranked in terms of the magnitude of obtained improvement scores; where two items obtained the same improvement score, they were ordered by amount of improvement possible. Column II of the Table shows obtained improvement scores and column III records the predictions we had made of the effectiveness of the film in teaching the answer to each quiz item. A Pearson product moment correlation coefficient of .34 was obtained as an index of the strength of our ratings to

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* There are four items which showed losses of -10%, -28%, -30%, and -65%. These figures were obtained by a slightly different arithmetic procedure, as follows: The proportion of "sound only" students answering correctly was taken directly as maximum possible loss; actual loss from "sound only" to film was then expressed as a fraction of "sound only" proportion correct rather than as 100% minus "sound only" percentage correct. Thus it appears that, on occasion, the visual may actually interfere with the teaching effectiveness of the sound track.

Table 1: Quiz items ranked by (a) actual obtained per cent of possible improvement and (b) magnitude of possible improvement in cases of a tie on criterion a).

Item No.	Improvement	Prediction	Item No.	Improvement	Prediction
19	100	3	10	35	1
13	100	3	12	30	1
36	100	3	32	30	-1
38	82	3	37	26	3
39	77	3	26	26	2
14	76	1	22	22	2
3	76	3	11	19	1
43	73	0	34	18	2
15	64	2	6	17	2
40	63	2	31	14	2
33	62	2	7	12	3
35	61	1	28	10	2
4	58	0	16	10	1
24	57	2	29	01	0
25	56	1	27	-.10	0
42	56	0	18	-.28	2
8	54	3	23	-.30	1
21	53	1	30	-.65	2
17	52	1			
41	51	3			
9	47	0			
5	44	0			

predict actual improvement on the set of quiz items. This correlation coefficient, while statistically significant ($t = 2.3$, $df = 39$, $p < .05$) is unhappily small and by no stretch of the imagination could be said to confirm our rating system as a very efficient approach to assessing the teaching effectiveness of an existing instructional film. This rating procedure <u>does</u> improve one's prediction of effectiveness, but the improvement is small, and since the prediction system assumes the existence of a quiz or other relatively definite statement of what one wants the film to teach, testing directly and empirically using some form of quiz seems the obvious path to greater certainty about the impact of the film.

We performed a post mortem of our predictive ratings by exhuming the film and screening with particular attention given to those sections where our predictions were in substantial error. We were in hopes that some relatively simple modification of the basis on which the predictive ratings were made would yield a better fit on those quiz items, but no such happy outcome occurred. In some cases we realized that what appears to be a clear case of visual supplement to narrative informational context in fact demands some relatively complicated and quick associations, as in the following example: The narrative information at the very end of paragraph I and continuing through paragraph II about where olives are grown is illustrated by a rather clear map of California which changes colors in the geographical areas noted in the narration. The quiz question,

however, requires only recognition of the names of these areas, not where these areas are geographically. If a child knew these geographical areas by name, the visual emphasis achieved by the changing color would definitely supplement the narration. In the absence of any knowledge about the typical subject's storehouse of geographical information, our predictive rating of +2 was obviously a fantasy, and one which went unconfirmed by the rather low actual improvement score of 17% (see Table 1).

Another case of similar confusion was complicated by what we believe to be a competing visual stimulus. Item #18, which we rated at +2, but which showed an actual loss, asks the subject to indicate the "first step in processing" which is cleaning, as shown and discussed in paragraph VII of the film. First, though the film clearly shows olives being dumped into and passing over the rollers of a machine called a cleaner by the narrator, it is not visually obvious that the olives are actually being cleaned; one must simply take the narrator's word for it that the olives come out "cleaner" (less leaves and twigs) than when they entered the machine. Thus the film shows a cleaner, but does not show the cleaning. Second, the "cleaning" sequence is followed immediately by visually clear and compelling shots of women hand-sorting olives; "hand-sorting" is the most frequently chosen wrong answer given to item #18, suggesting that the hand-sorting sequence, by following so closely and being relatively clear and powerful visually, may be complicating recall of the cleaning step which precedes it. Finally, it is reasonable

to assume that the children are uncertain as to where, in the life cycle of an olive, "processing" begins; the film does not make clear what step in the handling and treatment of olives marks the beginning of "processing." Given such possible confusion, "hand-sorting" may well be seen as the first step in processing simply because it is the first indoor event shown in the life of an olive.

Every quiz item which came under the scrutiny of our post mortem provided new and interesting possibilities for hypotheses about how films convey information and how people "read" films. In some cases, it was clear that while the answer to a given item was presented at a given point in the film, more or less explicit versions of the same information exist elsewhere in the film. In some cases where greater improvement than expected was obtained, part of the correct answer was very clearly illustrated by the film and knowing just that part allowed the student to eliminate all the wrong alternative answers.

In some cases, intense screening served only to deepen the mystery of the error in our prediction. In any case, the relationship between quiz item, answer alternatives, and film consistently revealed itself as more subtle and complex than had been anticipated.

Discussion

It is clear from this research that an instructional film can be adequately tested on relatively small samples of pupils prior to its adoption. Such testing can provide much more systematic

information on what the film teaches or does not teach of curriculum objectives that can be specified in some detail.

The next step in the process is to construct a new film testing at every major step in the production process from script to story board to sound track to film segments to the unmarried sound track (dual system projection) before the final film is completed.

Appendix A: Integrated Verbal Sequences

Sequence Number	Footage/ Frame	Content
1	00.00- 20.10	History
2	20.10- 27.25	Economics; current status of olive industry and relation to history.
3	27.25- 35.35	Geography; climate need for and location of olive orchards.
4	35.35- 49.15	Production of olive oil.
5	49.15- 57.25	Economics; general state of olive industry.
6	57.25- 72.30	Care of the trees.
7	72.30- 78.25	Harvest time, labor requirements.
8	78.25-103.05	Method of picking and rationale.
9	103.05-122.25	Quantity, harvest, and handling on receipt at plant.
10	122.25-134.25	Perishability and processing.
11	134.25-150.25	Processing; cleaning, hand-sorting, and sizing.
12	150.25-162.00	Logistics; relation of size and condition to final product.
13	162.00-195.00	Processing; undersized olive as Spanish style.
14	195.00-200.00	Economics; stuffed Spanish style olives from Spain.
15	200.00-219.00	Logistics; holding of bulk of olives in tanks.
16	219.00-259.35	Processing; black ripe olives.
17	259.35-269.35	Processing; pitting the olives.
18	269.35-318.00	Processing; final quality check before boxing for shipment.
19	318.00-323.35	Economics; number of olive processing plants.
20	323.35-338.00	Economics; public relations for California olive industry.

Appendix B

The following is a breakdown of The Olive Industry into a set of basically visual units. The schema for the breakdown is essentially arbitrary, and other breakdowns could be achieved, no more nor no less defensible or arbitrary. The breakdown offered here is according to Breitrose, though an almost identical one had been concocted previously and independently by Jecker. This breakdown is structured analogically into "paragraphs" (relatively larger, molar segments) and "sentences", or "statements" (relatively smaller more specific, molecular segments). The verbal message of The Olive Industry is synched to the breakdown in visual units.

Moviola Footage	Paragraph Number	Sentence Number	Description of Visual	Verbatim Verbal Accompanyment
00.00- 28.24	I		Historical context of the olive industry, transition to present state.	
00.00- 08.24		a	Olives on branch of tree.	"The olive industry is part of
08.25- 13.30		b	Spanish-style mission church.	California's Spanish heritage. The olive trees were brought to the missions by the padres, who crushed the fruit to make olive oil for food and
13.31- 17.11		c	Crushing wheel in churchyard.	fuel. Their old crushing wheels now stand idle
17.12- 20.09		d	Olive press in churchyard.	and their hand presses are dry and rusty.
20.10- 28.24		e	Slow pan across olive trees, down road running through orchard.	But the mission olive trees were the ancestors of vast commercial orchards that today make California the largest producer of olive products in the United States. Because of California's mild

28.25- 35.24	II	Geography; where olives are grown and why.	
28.25- 30.24	a	Map of California.	climate, olives are grown successfully in the great
30.25- 35.24	b	Map turns orange/red in valleys and southern coast.	central San Joaquin and Sacramento valleys and in the coastal areas of southern California.
35.25- 45.19	III	Production of olive oil	
35.25- 38.24	a	Crushing wheel, moving	"Olives are still crushed by heavy stone wheels
38.25- 40.24	b	Press pressing sacks of olives, slowly	and sacks of crushed fruit are pressed
40.25- 45.19	c	Olive oil running out of wooden spigots	to extract the oil. The production of olive oil is limited in California
45.20- 57.11	IV	Relation of quantity of olive oil produced to quantity of olives canned; also, comment on growth of olive industry.	

45.20- 51.19	a	Two men dumping crates of olives into hopper	because the high quality of the olives grown there makes them more valuable as a canning fruit. The olive industry is growing in economic value and
51.20- 57.11	b	Same scene (a), start zoom in on sign on hopper until only sign and hopper are in the frame	requires an increasing number of workers.
57.12- 57.28		Black	
57.29-102.31	V	Care and growth of olive trees; time of year and method of harvesting (emphasizes hand operations)	
57.29- 65.11	a	Man pruning tree, moving	Care of the olive groves is a continuing program. Pruning is necessary to keep the growth under control and to make harvesting of the fruit easier.
65.12- 69.31	b	Sprinklers sprinkling in orchard	The trees require an abundant water supply
69.32- 74.38	c	Olives on branches	to produce a commercial fruit crop. The olives are ready to harvest early in October
74.39- 79.38	d	Two men on ladder in trees picking olives	and picking continues into December. Hundreds of trained workers are needed to pick the crop. The olives are picked by hand

79.39- 86.14	e	One man, on ladder in tree, picking olives	to prevent damage to the delicate fruit.
86.15- 97.32	f	One man, on ladder in tree, picking olives (86.37), descends ladder (89.37), walks toward camera (91.02), dumps olives in crate (93.09), smooths over olives.	
97.33-102.31	g	Man driving truckload of olives through orchard.	
102.32-130.00	VI	Transportation of picked olives into processing plant yard, from yard into plant; when and why	
102.32-106.04	a	Truck pulling into weighing station	During the peak of the harvest season, a continuous
106.05-115.19	b	Forklifts removing stacks of crates of olives from truck, transporting them around yard, stacking	supply of olives moves into the packing plant.
115.20-122.13	c	Pan across stacks of crates of olives in yard	Each truckload of olives is weighed and marked with the grower's name, then stacked in the receiving yard ready for processing.
122.14-127.01	d	Two men loading crates on moving conveyor belt	Because olives are a perishable fruit, the processing begins as soon as possible.
127.02-130.00	e	Crates moving at angle (up) on conveyor belt	

130.01-161.24	VII	Cleaning, quality grading, sizing, and immediate processing; one type of final product (ripe green olives)	
130.01-140.04	a	Crates of olives being mechanically dumped into "cleaner"	As the olives enter the plant, they pass over a cleaner that removes leaves and twigs.
140.05-143.20	b	Shute of olives passing foreground, women hand-sorting olives in the background	Hand-sorting
143.21-147.20	c	Closeup of hands sorting olives	removes damaged or overripe fruit not suitable for canning.
147.21-150.23	d	Top view of olives moving in sizing machine	The good olives are separated in various sizes.
150.24-154.34	e	Bottom view of olives moving in sizing machine, dropping into shute below sizer	The size and condition of the fruit determine how the olives will be handled.
154.35-158.00	f	Hand-picking olives for immediate canning	Some of the fruit is processed immediately
158.01-161.24	g	Clear glass bowl of pitted green olives	and canned as green ripe olives.
161.25-162.03		Black	

162.04-199.04	VIII	Handling and treatment of "undersized olives", processing as Spanish style olives	
162.04-166.03	a	Two men watching olives pour down shute into barrel	The undersized olives are treated in caustic soda for two or three days and
166.04-167.07	b	Closeup of olives pouring into barrel	then transported into wooden barrels.
167.08-169.00	c	Hands smoothing surface of olives in barrel	
169.01-171.08	d	Man moves in front of camera and, facing barrel (away from camera), wheels barrel away	
171.09-174.32	e	Closeup of man hammering lid into top of barrel	
174.33-177.32	f	Longer range shot of same man (as in e) placing and hammering ring on barrel	
177.33-180.24	g	Man pumping salt brine into barrel	Salt brine is added and the barrels are
180.25-185.20	h	Man hammering bung into barrel, rolls it away on tracks	sealed. The
185.21-191.22	i	Slow pan on stacks of barrels of olives	olives are stored in the warm sunshine for six to nine months to ferment and cure. After this fermentation process, these olives

219.08-223.10	a	Hand-sorting, closeup	When processing begins, the olives are hand-sorted once more, and transferred
223.11-227.10	b	Olives pouring into vat	to wooden vats where they will be processed for six days. For a short time each
227.11-230.13	c	Olives in bubbling, frothy vat	day, a caustic soda solution is used to leach the bitter taste from the olives.
230.14-231.28	d	Olives in bubbling (aeriated) vat	Then air is
231.29-233.36	e	Man appears, scoops out olives	pumped through fresh water to oxidize the olives.
233.37-236.10	f	Man picks handful of olives out of scoop.	Oxidation turns the olives black.
236.11-241.06	g	Closeup of man's hand picking olives out of scoop, all olives dumped back in vat	As the processing
241.07-244.12	h	Man in white lab coat (chemist) looking at instrument on bench	continues, chemists check the condition of the solutions.
244.13-250.39	i	Hands, hold and slicing olives, squirting liquid on it	Each day, the olives are examined to see how far the caustic soda has penetrated.

191.23-194.17	j	Bowl of Spanish style olives, pitted, with pimentos	are packed as Spanish style olives.
194.18-199.04	k	Bowl of stuffed Spanish style olives	Stuffed Spanish style olives come from Spain, where hand labor costs are low.
199.05-199.22		Black	
199.23-218.29	IX	General discussion of handling and type of processing of the bulk of all olives as black ripe olives	
199.23-204.39	a	Slow pan across olives moving on sizer to man raking olives in catcher bin under sizer	Because of the large quantity of olives received during the short harvest season, most of the olives are sized and
204.40-208.05	b	Olives moving in shute	diverted to redwood holding tanks.
208.06-210.32	c	Olives pouring out of pipe into tank	These olives are covered with salt brine and stored
210.33-218.29	d	Slow pan out of tank to tops of several tanks	until the plant is ready to process them as black ripe olives.
218.30-219.07		Black	
219.08-259.32	X	Details of processing of black ripe olives	

251.00-259.32	j	Arms, scooping black olives out of bubbling vat, raking through olives, dumping back in vat	When the olives are sweet and black, they are treated to neutralize the caustic soda. After being washed, they are covered with salt brine and pasteurized.
259.33-269.35	XI	Pitting	
259.33-263.08	a	Man walking around three pitting machines	Some of the cured olives go to the pitting room where machines running
263.09-269.35	b	Slow motion closeup of pitting machine	at high speed punch out the pits. Slow motion photography allows us to see how the machines work.
269.36-282.01	XII	Hand sorting	
269.36-276.00	a	"Final quality check" hand sorting	All of the olives are given a final check for quality before they move on to the canning machines.
276.01-282.01	b	Closeup of hand sorting	
282.02-297.33	XIII	Canning, quality control and additives	
282.02-283.04	a	Cans moving in and out of canning machines	
283.05-289.08	b	Same shot as a, different angle, shows olives too	

289.09-292.07	c	Woman taking olives out of cans moving on belt	An inspector checks each can to make
292.08-295.11	d	Same shot as c, closeup	sure it is the correct weight.
295.12-297.33	e	White powder being mechanically dumped into each can of olives, moving on a belt.	Water and salt are added.
297.34-308.20	XIV	Sterilizing	
297.34-308.20	a	Man puts stack of cans of olives into cylindrical vault, closes door, spins wheel on door.	The cans are sealed, and moved into a pressure cooker to be sterilized.
308.21-317.23	XV	Labeling and boxing cans of olives	
308.21-311.24	a	Labeled cans spinning along a set of tracks	After cooling, the cans are labeled and boxed, ready
311.25-317.23	b	Cans dropping, along sets of tracks, into stack, stack pushed into box, box closed, man stacks new box in machine	for shipment.
317.24-318.02		Black	
318.03-338.00	XVI	General size, methods, and purpose of olive industry	

318.03-323.28	a	Slow pan of truck moving behind chain link fence	Many olive plants are busy supplying olive products to the market.
323.29-331.35	b	Pan of shelf stacked with different brands of canned olives	Most of the olives we see on our market shelves were grown and processed in California. California's olive industry is the result of years of experimentation and testing
331.36-338.00	c	Bowl, half full of green olives, into which black olives are poured, slow motion - titles	to produce a quality product for the markets of the world.

Appendix C

Test A

1. Who brought the first olive trees to California? _____

2. What did the early Californians use olives for? _____

3. What has happened to the equipment the early Californians used?

   a) still in use

   b) idle and rusty, no longer in use

4. California ranks _____ among the states in production of olives.

   a) first

   b) second

   c) tenth

5. What kind of climate is needed to grow olives?

   a) mild all year

   b) cold winters and mild summers

   c) mild winters and hot summers

   d) cold winters and hot summers

6. Where are olives grown in California?

   a) San Joaquin valley

   b) Sacramento valley

   c) Southern coast

   d) all of the above

7. How is olive oil made?

   a) by crushing the olives

   b) by pressing the olives

   c) both (a) and (b)

   d) none of the above

8. What kind of equipment is used to <u>crush</u> olives <u>today</u>?

   a) stone wheels

   b) metal wheels

   c) wooden wheels

   d) none of the above

9. Most of the olives grown in California are

   a) processed and sold as olive oil.

   b) sold fresh.

   c) processed and sold as canned olives.

   d) none of the above

10. How often do olive trees need care?

   a) never

   b) sometimes, but not too often

   c) often

11. Why are olive trees pruned?

   a) to control their growth

   b) to make harvesting easier

   c) both (a) and (b)

   d) olive trees are not pruned

12. When are olives usually ready to be picked?

a) June

b) August

c) October

d) February

13. How are olives harvested?

a) by machines which shake the whole tree

b) by hand

c) by knocking them out with sticks

d) They fall off and men pick them off the ground.

14. Olives are harvested as they are because

a) it's the easiest way.

b) it's least expensive.

c) it's the best way to prevent damage to the olives.

d) none of the above

15. How much water do olive trees need?

a) none

b) only a little

c) some, but not much

d) a lot

16. How many workers are needed to pick the olive crop?

a) about fifty for each olive grove

b) hundreds

c) several thousand

17. When a truckload of olives first arrives at the plant, what is done to it?

a) weighed, marked and stacked

b) tasted to see if they're any good

c) covered with salt brine

d) the good ones are sorted out

18. What is the first step in processing the olives?

a) sizing

b) cleaning

c) hand sorting

d) covered with salt brine

19. Damaged and overripe olives are removed

a) by hand sorting.

b) by machine sorting.

c) before the olives are delivered to the plant.

20. Green ripe olives are

a) stored in the warm sunshine for six to nine months.

b) processed and canned immediately after they arrive at the plant.

c) discarded because they're no good.

d) used to make olive oil.

21. Cleaning removes _____ from the olives.

a) dirt and twigs

b) leaves and dirt

c) leaves and twigs

d) all of the above

22. How is the processing of Spanish style olives different from that of green ripe olives?

a) Green ripe olives are bathed in caustic soda.

b) Spanish style olives are bathed in caustic soda.

c) Spanish style olives are allowed to ferment.

d) Green ripe olives are allowed to ferment.

23. The undersized olives are canned and sold as Spanish style olives.

a) true

b) false

24. The undersized olives are placed in barrels and put in the sunshine for six to nine months to ferment and cure.

a) true

b) false

25. All olives are stored in the sunshine for six to nine months before they are canned.

a) true

b) false

26. What is added to the Spanish style olives just before they are put in the sun?

a) caustic soda

b) salt brine

c) cold water

27. Spanish style olives are treated with caustic soda before they are fermented.

a) true

b) false

28. Most of the olives that come into the plant are

a) processed immediately and canned as green ripe olives.

b) sized and put in big redwood tanks.

c) put in barrels, covered in salt brine, and stored in the sunshine.

d) processed immediately and canned as Spanish style olives.

29. Most olives are canned as

a) Spanish style olives.

b) green ripe olives.

c) black ripe olives.

30. Most olives are covered in salt brine and stored because

a) it's necessary to let them cure.

b) there are too many to process immediately.

c) they have to age.

d) none of the above

31. What causes olives to turn black?

a) caustic soda

b) salt brine

c) air pumped through water

32. What takes the bitter taste out of the olives?

a) caustic soda

b) salt brine

c) air pumped through water

33. What do chemists do during the black olive processing?

a) carefully control the action of the caustic soda

b) carefully control the action of the salt brine

34. The first step in processing black ripe olives is

a) to leach out the bitter taste.

b) to turn them black.

c) to hand sort them again.

d) to pasteurize them.

35. What happens in the pitting room?

a) The pits of the olives are stuffed.

b) The pits of the olives are removed.

c) The pits of the olives are canned.

d) all of the above

36. Pitting machines run very

a) fast

b) slow

37. Just before black ripe olives are canned, they are given a final check for

a) size.

b) bitter taste.

c) quality.

d) all of the above

38. Just before the salt and water are added to cans of black ripe olives, an inspector checks each can to

a) be sure it doesn't contain damaged olives.

b) be sure all the olives turned black.

c) be sure it is the right weight.

d) all of the above

39. Water and salt are added to each can of black ripe olives

a) mechanically.

b) by hand.

c) water and salt are not added

40. A pressure cooker is used to

a) cook the olives.

b) sterilize the cans.

c) turn the olives black.

d) seal the cans.

41. The last step, before shipment, in processing black ripe olives is

a) boxing and labeling.

b) sterilizing.

c) none of the above

42. How many olive plants are there in California?

a) one

b) only a few

c) many

43. Most of the olives in the market are

a) grown outside of California but processed in California.

b) grown in California and processed in California.

c) grown in California but processed outside of California.

d) grown outside of California and processed outside of California.